"Morpho-taxonomical and Phytochemical studies on some Ethno-Medicinal plants used as 'anti-Ophidians' among the Munda tribes of Hazaribag District of Jharkhand"

SYNOPSIS

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1. TITLE OF THE THESIS

"Morpho taxonomical and Phytochemical studies on some Ethno-Medicinal plants used as 'anti-Ophidians' among the Munda tribes of Hazaribag District of Jharkhand".

2. INTRODUCTION

The Ethnobotanical Tapestry of Jharkhand

The intertwining of human culture and the plant kingdom represents one of the oldest dialogues in evolutionary history. In the mineral-rich and biologically diverse landscape of **Jharkhand**, often referred to as the **"Land of Forests,"** this dialogue is not merely historical—it is a lived reality. For the indigenous communities of this region, particularly the **Munda tribes**, the forest is not just a resource; it is a profound pharmacopoeia, a spiritual sanctuary, and a genetic heritage.

Among the myriad challenges faced by forest-dwelling communities, **ophidism** (snakebite) remains a critical, yet often neglected, public health crisis. In the rugged terrains of the **Hazaribag District**, where modern clinical intervention is frequently hampered by geographical isolation and socioeconomic constraints, the **Munda** people have developed a **sophisticated, time-tested system of traditional medicine**. Central to this system is the use of **'anti-Ophidians'**—botanical entities utilized to neutralize venom, manage systemic symptoms, and facilitate recovery following a snakebite.

The Scientific Imperative: Morpho-Taxonomy and Phytochemistry

While traditional knowledge offers a foundational map, the transition from **folk-wisdom** to evidence-based medicine requires rigorous scientific validation. This research is anchored in two critical pillars of botanical science: **Morpho-taxonomy and Phytochemistry**.

1. Morpho-Taxonomical Precision: The efficacy of any medicinal plant begins with its identity. Misidentification in ethno-medicine can lead to ineffective treatments or, worse, toxic outcomes. By employing detailed morphological analysis—ranging from

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macroscopic floral architecture to microscopic epidermal traits—this study seeks to provide a definitive taxonomic baseline for the anti-Ophidian flora used by the Mundas.

2. The Phytochemical Arsenal: The "anti-Ophidian" property of these plants is not magical; it is molecular. Plants produce a diverse array of secondary metabolites—alkaloids, flavonoids, terpenoids, and tannins—which may act as competitive inhibitors to snake venom enzymes (such as phospholipase A_2 or hyaluronidase). Understanding these chemical profiles is essential to unlocking the mechanism of action behind traditional cures.

The Socio-Ecological Context: The Munda Tribes of Hazaribag

The Hazaribag District, characterized by its undulating plateaus and dry deciduous forests, serves as a unique ecological niche. The Munda tribes, one of the most prominent ethnic groups in the region, possess an intricate understanding of the local flora. Their **"Anti-Ophidian"** practices are often shrouded in a blend of empirical observation and ritualistic belief. However, as globalization and deforestation accelerate, this **Traditional Ecological Knowledge (TEK)** is at risk of erosion.

The present study acknowledges that the conservation of these plants is inseparable from the conservation of the culture that uses them. By documenting these specific ethno-medicinal species, this research serves as a bridge between the ancient tribal wisdom of Jharkhand and the global pursuit of novel bioactive compounds.

Problem Statement and Research Justification

Snakebite envenomation is classified by the World Health Organization (WHO) as a **High-Priority Neglected Tropical Disease.** In India, thousands of deaths occur annually, disproportionately affecting rural and tribal populations. While polyvalent antivenoms (ASV) exist, they face limitations including:

- ✓ High cost and specific storage requirements (refrigeration).
- ✓ Risk of anaphylactic reactions.
- ✓ Ineffectiveness against local tissue necrosis caused by certain species.

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Botanical "anti-Ophidians" offer a potential complementary therapy. Many of the plants used by the Munda tribes are believed to act locally, neutralizing venom at the site of the bite before it reaches systemic circulation. Despite this potential, there is a significant **data gap** regarding the specific flora of Hazaribag. A systematic study that combines taxonomic rigour with phytochemical screening is therefore not only academically relevant but a humanitarian necessity.

Objectives of the Study

The overarching goal of this research is to create a comprehensive scientific profile of the anti-Ophidian plants used by the Munda tribes. This will be achieved through:

Ethnobotanical Documentation: Identifying and recording the specific plant species and parts used (roots, bark, leaves) through field surveys and interviews with tribal healers (Pahans or Ojha).

Structural Characterisation: Performing detailed morpho-taxonomical studies to ensure accurate species identification and to identify diagnostic markers.

Phytochemical Profiling: Conducting qualitative and quantitative analyses to identify the major classes of bioactive compounds present in the selected species.

Bio-Prospection: Assessing the scientific potential of these plants as templates for future drug development in the treatment of snake envenomation.

Conclusion of Introduction

This PhD thesis, titled **"Morpho taxonomical and Phytochemical studies on some Ethno-Medicinal plants used as 'anti-Ophidians' among the Munda tribes of Hazaribag District of Jharkhand,"** represents a multidisciplinary endeavour. It sits at the intersection of **Botany, Ethnography, and Pharmacology.** By validating the **"Green Pharmacy"** of the Munda people, we seek to honour indigenous heritage while contributing to the global pharmacopeia, ultimately transforming traditional "lore" into verifiable "science."

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3. REVIEW OF LITERATURE

3.1. Global and National Perspectives on Snakebite Envenomation

Snakebite envenomation is a critical, yet frequently neglected, tropical disease that disproportionately affects rural and indigenous populations globally (Sahu et al., 2015). In India, the "Big Four"—Daboia russelii (Russell's Viper), Naja naja (Spectacled Cobra), Bungarus caeruleus (Common Krait), and Echis carinatus (Saw-scaled Viper)—account for the majority of fatalities (Binorkar & Jani, 2012). While polyvalent anti-snake venom (ASV) remains the primary clinical intervention, its limitations include high costs, cold-chain requirements, and potential for severe hypersensitivity reactions (Mukherjee et al., 2008). Consequently, research into plant-derived *anti-ophidians* has gained momentum as a complementary therapeutic strategy (Sahu et al., 2015).

3.2. Ethnobotanical Legacy of the Munda Tribes

The state of **Jharkhand** is a significant repository of ethnobotanical wisdom due to its dense forest cover and high concentration of tribal communities (Kumari, 2018). The **Munda tribes**, one of the oldest ethnic groups in the Hazaribag region, possess a specialised understanding of local flora (Kumari, 2018).

3.3. **Documentation of Traditional Knowledge (TK):** Studies have identified that the Munda people utilise a variety of plant formulations, including pastes, decoctions, and powders, to treat snakebites (Kumari, 2018).

3.4. **Key Species:** Aristolochia indica and Rauvolfia serpentina are frequently cited in regional literature as critical components of tribal anti-venom treatment (Kumari, 2018; Sahu et al., 2015).

3.5. **Administration Routes:** Traditional healers (often known as Vaidhyas or Ojhas) utilise oral administration of root pastes and topical application at the bite site to inhibit the spread of venom (Kumari, 2018).

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3.6. Morpho-Taxonomical Investigations

The scientific validation of ethno-medicinal plants begins with rigorous **morpho-taxonomical** identification (Kumari, 2024). Morphological studies focus on macroscopic and microscopic features, ensuring the authenticity of the plant material and preventing the use of adulterants (Kumari, 2024).

3.7. **Field Taxonomy:** In Hazaribag, botanical identification is often guided by vernacular names like *'Ghunchi'* (Abrus precatorius) or *'Bach'* (Acorus calamus), but requires professional taxonomic verification using standard flora databases (Kumari, 2018; Kumari, 2024).

3.8. **Diagnostic Markers:** Recent research underscores that identifying specific parts—such as rhizomes, tubers, or bark—is essential, as bioactive efficacy often varies significantly across different plant organs (Kumari, 2018).

3.9. Phytochemical Foundations of Anti-Ophidian Activity

The therapeutic potential of these plants is attributed to their complex **phytochemical** profiles (Binorkar & Jani, 2012). Secondary metabolites act as natural inhibitors against the enzymatic components of snake venom (Sahu et al., 2015).

3.10. **Enzymatic Inhibition:** Bioactive molecules target key venom enzymes such as **Phospholipase** A_2 (PLA2), hyaluronidases, and metalloproteinases (Mukherjee et al., 2008; Sahu et al., 2015).

3.11. Specific Bioactive Compounds:

3.11.1. **Alkaloids:** Atropine and compounds from Azadirachta indica have demonstrated the ability to neutralize PLA2 activity (Mukherjee et al., 2008).

3.11.2. **Phenolic Acids:** 2-hydroxy-4-methoxy benzoic acid isolated from Hemidesmus indicus has been shown to neutralize the lethal and hemorrhagic effects of Vipera russelii venom (Binorkar & Jani, 2012).

3.11.3. **Steroids:** *B*-sitosterol and stigmasterol, found in various regional plants, exhibit anti-inflammatory properties that mitigate venom-induced tissue damage (Binorkar & Jani, 2012).

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3.12. Research Gaps and Future Outlook

Despite the extensive use of traditional remedies in the **Hazaribag District**, there is a notable lack of integrated studies that combine precise **morpho-taxonomical documentation** with **quantitative phytochemical screening** specifically for the Munda tribe's pharmacopeia (Kumari, 2018). Many studies are either purely ethnographic or focused on isolated chemical compounds (Binorkar & Jani, 2012).

This research aims to bridge this gap by providing a comprehensive scientific characterisation of these "anti-Ophidians," facilitating the potential development of standardised, plant-based adjunct therapies that are culturally sensitive and ecologically sustainable (Sahu et al., 2015).

4. OBJECTIVES/ NEED OF THE THESIS

1. To conduct an ethnobotanical survey among the Munda tribes of Hazaribag to identify plants used against snakebites.
2. To perform detailed morphotaxonomical studies of the identified species for accurate scientific identification.
3. To carry out preliminary phytochemical screening to detect primary and secondary metabolites.
4. To evaluate the quantitative presence of specific bioactive groups (e.g., phenolics, flavonoids).

5. PROPOSED METHODOLOGY

4.1 Study Area

The research will be conducted in the Hazaribag district, focusing on Munda-dominated blocks such as Barkagaon, Churchu, and Ichak.

4.2 Ethnobotanical Survey

Information will be collected through semi-structured interviews with traditional healers (*Vaidyas/Ojhas*). The "Snowball Method" will be used to identify key informants.

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4.3 Morpho-taxonomical Characterisation

Plants will be identified using standard floras (e.g., The Flora of Bihar and Orissa by Haines). Morphological traits such as leaf phyllotaxy, floral symmetry, and seed structure will be documented.

4.4 Phytochemical Analysis

The plant parts (roots, bark, leaves) will be dried and extracted using various solvents (Methanol, Ethanol, Aqueous).

4.4.1. Qualitative Tests: Wagner's test (Alkaloids), Shinoda test (Flavonoids), and Foam test (Saponins).

4.4.2. Quantitative Analysis: Estimating total phenolic content (TPC) and total flavonoid content (TFC) using spectrophotometry.

6. POTENTIAL ANTI-OPHIDIAN PLANTS OF INTEREST

Based on preliminary surveys and regional literature (Kumari, 2018; Upasani et al., 2017), the following species are likely candidates:

S.N.	Botanical Name	Family	Local Name	Parts Used
1.	Andrographis paniculata	*Acanthaceae*	*Kalmegh*	Whole Plant
2.	Aristolochia indica	*Aristolochiaceae*	*Isharmul*	Root
3.	Rauvolfia serpentina	*Apocynaceae*	*Sarpagandha*	Root
4.	Achyranthes aspera	*Amaranthaceae*	*Chirchiri*	Root/Leaf

5. SIGNIFICANCE OF RESEARCH AND EXPECTED OUTCOMES

The significance of this research lies at the intersection of traditional wisdom and modern pharmacological innovation. By investigating the "**anti-Ophidians**" of the Munda tribes, this study transcends simple botanical documentation to address global health, cultural preservation, and chemical discovery.

1. Contribution to the Global Pharmacopeia and Drug Discovery

This research serves as a vital ***bioprospecting mission. Snake venom is a complex cocktail of proteins and enzymes (such as Phospholipase A_2, proteases, and hyaluronidases). Modern medicine relies almost exclusively on equine-derived antivenoms, which are costly and carry a high risk of anaphylaxis. By identifying the phytochemical constituents of plants used by the Munda tribe, this study provides a scientific "blueprint" for the development of novel,***

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plant-based enzyme inhibitors. These compounds could eventually lead to the synthesis of low-cost, shelf-stable adjunct therapies to supplement conventional antivenom.

2. Validation and Preservation of Indigenous Knowledge (IK)

Indigenous knowledge is frequently oral and therefore fragile. As the younger generations of the Munda community migrate towards urban centres, the specific "pharmacognostic" wisdom of the Ojhas (traditional healers) faces the threat of extinction. This study provides an **intellectual safeguard** by documenting this ethno-medicinal heritage through a rigorous academic lens. It elevates tribal lore to the status of recognized science, ensuring that the Munda people's contribution to human health is acknowledged and protected under Intellectual Property Rights (IPR) frameworks.

3. Addressing a "Neglected Tropical Disease" (NTD)

Snakebite envenomation is classified by the WHO as a high-priority Neglected Tropical Disease. It is a "disease of poverty" that disproportionately affects the agricultural and tribal workforce of Jharkhand. This research has profound **socio-economic significance**; by scientifically validating local botanical resources, it empowers rural communities with evidence-based alternatives or first-aid measures in "the golden hour" before they can reach a distant clinical facility.

4. Taxonomic Precision and Standardisation

A significant barrier to the use of herbal medicine is the lack of standardization and the prevalence of adulteration. The **morpho-taxonomical** component of this research establishes definitive diagnostic markers for medicinal plants in the Hazaribag region. This creates a "**Botanical Standard**" that ensures future researchers and pharmacists can identify the correct species with microscopic and macroscopic certainty, thereby improving the safety and reproducibility of herbal treatments.

5. Ecological Conservation and Biodiversity Advocacy

The study highlights the inextricable link between **biological diversity and human survival**. By demonstrating the medicinal value of the Jharkhand forests, the research

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provides a powerful argument for the conservation of the Hazaribag ecosystem. It shifts the perception of the forest from a source of timber to a "living laboratory." Identifying the conservation status of these specific anti-Ophidian plants encourages the implementation of sustainable harvesting practices and the protection of the specialised habitats required for these bioactive species to thrive.

In summary:

I. Documentation of rare anti-venomous traditional knowledge.
II. Scientific validation of the Munda tribe's ethno-pharmacopoeia.
III. Identification of potential lead compounds for the development of herbal anti-venom supplements.

9. PROPOSED CHAPTER PLAN

1. Chapter I: Introduction and Scope.
2. Chapter II: Review of Literature.
3. Chapter III: Materials and Methods.
4. Chapter IV: Morphotaxonomical Description of Selected Plants.
5. Chapter V: Phytochemical Profiling and Statistical Analysis.
6. Chapter VI: Discussion.
7. Chapter VII: Summary and Conclusion.

10. TIMELINE (GANTT CHART PROPOSAL)

Year 1: Literature review, field surveys, and sample collection.

Year 2: Taxonomic studies and laboratory phytochemical analysis.

Year 3: Data interpretation, paper publication, and thesis writing.

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